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Re: Review of the Responses to Comments on the Joint Agency Memorandum, Review of the Groundwater Model, Final Remedial Design and Remedial Action Work Plan Addendum #2 (RDRAWP Addendum 2) for Operable Unit 2 Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base Mesa, Arizona, August 2017

Dear Ms. Jerrard:

EPA has reviewed the Air Force's comments on the Time of Remediation (TOR) estimates memorandum prepared by Praxis. This memorandum was developed because the model presented in the RDRAWP Addendum 2 could not be independently reviewed and verified. Due to the RDRAWP Addendum 2 groundwater Model complexity, it is still not possible to independently evaluate the predictive EBR simulations (e.g., 20-year benzene concentration predictions) because no model outputs are presented in the RDRAWP Addendum 2. The purpose of the memorandum was to demonstrate a reasonable estimate for Time of Remediation for EBR to achieve cleanup of the site. We provide the following responses to AFs review of the memorandum; as well as AFs response to EPA's March 24, 2017 comments on the model presented in the RDRAWP Addendum 2:

COMMENT ON THE PREAMBLE PRECEEDING THE RESPONSES TO EPA COMMENTS

1. It appears that there is a fundamental misunderstanding about the purpose of conducting sensitivity analyses for the groundwater model. For example, the second paragraph states, "Using sensitivity analysis to evaluate possible results based on ranges for multiple parameters will result in a wide range of outcomes, some of which are likely not representative of actual site outcomes. This approach can hinder decision making based

on the lack of clarity associated with considering multiple combinations of input parameters." However, the purpose of a sensitivity analysis is to evaluate the scope of potential outcomes of the model in order to assess whether the model is sensitive to one or more specific parameters and to demonstrate that reasonable parameters were chosen as the basis for the model. Sensitivity analyses are not intended to hinder decision making, but to provide data to allow reviewers to (i) confirm that the parameter values chosen for the model are reasonable, (ii) better understand the key physical mechanisms that control site-specific chemical fate and transport, (iii) identify parameters that need to be monitored, and (iv) determine where additional testing is needed. Without the results from sensitivity analyses, there is more uncertainty that the model is a reasonable representation of ST012. For example, there is no hydraulic information specific to the Cobble Zone (CZ) and as a result literature values and educated guesses were used to generate model input parameters for this zone, which indicates that slug tests and/or aquifer tests should be conducted to obtain the missing information. It is critical to obtain this information for future model runs. The paragraph also states, "Future modeling and/or sensitivity analysis will provide results based on best available parameter estimates and prioritize potential parameters for further evaluation," but in most cases this prioritization can be done based on the lack of site-specific data for model input. Further, to the extent possible, future modeling should not be based on parameter estimates or literature values, but on site-specific parameters. Please ensure that sensitivity analyses are performed for future modeling and that necessary testing is done so that future models can be based on site-specific parameters rather than literature values or estimates.

EVALUATION OF RESPONSE TO EPA REVIEW COMMENTS DATED 24 MARCH 2017

Response to General Comment (GC) 1: The response partially addresses the comment. It should be noted that the Revised Draft Final Addendum #2, Remedial Design and Remedial Action Work Plan for Operable Unit 2, Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona (Addendum #2) did not include sufficient information to allow evaluation of the model. It is recognized that the response to GC 5 indicates that this information can be provided for future model runs. However, the response states that "the lack of rate-limited dissolution does not significantly affect the use of the model for EBR [enhanced bioremediation] design and implementation." This omission adds to the uncertainty associated with the model. For future model runs, please ensure that rate-limited dissolution is considered.

Response to GC 3: The response partially addresses the comment. The lack of site-specific data, particularly for the CZ, and the use of literature values adds significant uncertainty to the model results. Similarly, the lack of sensitivity analysis adds to the uncertainty of model results. Please collect data from the CZ, including the results of slug tests and/or aquifer tests, so that future model runs can be based on site-specific data, rather than guesses based on literature review. Also, please conduct sensitivity analyses for future model runs as requested in the original comment.

Response to GC 4: The response does not address the comment. However, in the interest of moving the project forward, the reactive-transport model should be used during future modeling. This will help to optimize the injection strategy in the future when data to substantiate chemical transport modeling will be available. It will likely be necessary to install wells to evaluate advection-dispersion, etc. Please collect sufficient data during Phase I of the sulfate injections to conduct reactive-transport modeling during future model runs.

Response to GC 5: The response partially addresses the comment. The additional plots are appreciated, but Addendum #2 did not provide all of the output requested in the comment. Further, the response does not commit to providing all of the information/output requested in the comment. Please ensure that all of the output requested in the original comment is provided for future model runs.

Response to GC 6: The response partially addresses the comment. It is not clear that the "maximum utilization rate that is 10 times the low value used in the UWBZ [Upper Water Bearing Zone]" is conservative as stated in the response because the sulfate-reducing microbial population is unknown. The Pilot Test that was conducted in the Lower Saturated Zone (LSZ) indicates that sulfate-reducing microbes are present, but similar data are not available for the other zones. As requested in the checklist, data are needed to evaluate the indigenous microbial population in the CZ, UWBZ, and LSZ. Please ensure that microbial population data are obtained.

Response to GC 7: The response does not address the comment. The response states that "a longitudinal dispersivity at 20 feet is conservative compared to lower dispersivities, which would limit the downgradient spreading." One of the key requirements of the EBR system is to maximize the mixing of sulfate throughout the treatment zones in order to enhance biodegradation. To evaluate advective transport of sulfate many groundwater model flow simulations were performed to optimize extraction/injection well locations and rates. However, sulfate mixing by longitudinal and transverse (horizontal and vertical) dispersion are separate transport processes that are very important in determining mixing of both the electron acceptor (sulfate) and the contaminant (BTEX, etc.) in the subsurface. Using overly large dispersivity values can introduce a significant amount of artificial sulfate and contaminant mixing into the EBR model, thus making the simulated EBR system appear more effective than the actual system will be upon field implementation. This is another example that illustrates the importance of performing multiple sensitivity analyses before completing the EBR system design. Please conduct dispersivity sensitivity analyses for future model runs as requested in the original comment.

Response to GC 8: The response partially addresses the comment. The response states that the "RD/RAWP and Addendum #2 models presented are deterministic and represent the best estimates for model parameters." However, insufficient information has been provided to substantiate the quoted statement. Sensitivity analysis is one way to demonstrate that the model parameters are a reasonable representation of subsurface conditions. In addition, the response suggests that sensitivity analysis would be used "to arrive at a worst case or near worst case outcome to assess the approach," but this is not the case. As stated above, sensitivity analysis provides information about the range of possible model outcomes and is used to demonstrate that

the model parameter values that were selected are indeed the "best estimates." Please ensure that all future model runs include sensitivity analyses.

If any questions regarding these comments, please contact me at (415) 972-3150.

Sincerely,

Carolyn d'Almeida

Carolyn d'Almeida
Remedial Project Manager